

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:<https://orca.cardiff.ac.uk/id/eprint/100903/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Roberts, Annette , Munday, Max , Roche, Neil , Brown, Adam, Armstrong, Mike, Hargreaves, Jodie, Pilgrim-Morrison, Sarah, Williamson, Kevin and Hyder, Kieran 2017. Assessing the contribution of recreational sea angling to the English economy. *Marine Policy* 83 , pp. 146-152. 10.1016/j.marpol.2017.05.028

Publishers page: <http://dx.doi.org/10.1016/j.marpol.2017.05.028>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Assessing the contribution of recreational sea angling to the English economy

Annette Roberts ^{a*}, Max Munday ^a, Neil Roche ^a, Adam Brown^b, Mike Armstrong^c, Jodie Hargreaves^d, Sarah Pilgrim-Morrison^d, Kevin Williamson^d, and Kieran Hyder^c

a. Cardiff Business School, Cardiff University, Cardiff, CF10 3EU, UK.

www.cardiff.ac.uk/business-school

b. Substance, Fourways House, 57 Hilton Street, Manchester M1 2EJ, UK.

www.substance.net

c. Centre for Environment, Fisheries & Aquaculture Science, Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK. www.cefas.co.uk

d. Marine Management Organisation, 9, Millbank, c/o 17 Smith Square, London, SW1P 3JR, UK. www.gov.uk/government/organisations/marine-management-organisation

* **Corresponding author:** Annette Roberts, Cardiff Business School, Cardiff University, Cardiff, CF10 3EU, UK. Tel: +44 (0) 29 208 75058, e-mail: robertsa1@cardiff.ac.uk

Abstract

Sea angling has been shown to be a high value activity with significant expenditure by individuals on their sport. Deriving estimates of the economic contribution of recreational sea angling is important in a number of related policy contexts, from tourism management and economic development policy, to the sustainable management of inshore fish stocks. This paper reveals some of the challenges in understanding the economic effects associated with recreational sea angling, and provides estimates of the economic value of recreational sea angling in England. The results were derived from research undertaken in England in 2011-13, which was conducted as part a wide ranging government-funded study, *Sea Angling 2012*, that estimated sea angler catches, spending and activity. Recreational sea angling made a significant contribution to the economy, supporting just over £2 billion of total spending, and 23,600 jobs in England in 2012-13. The implications of these results are discussed in the context of the management of recreational sea angling in England.

Highlights

- The paper estimates the economic contribution of recreational sea angling to England.
- Average angler spending, on trips and major items, was almost £1,400 in 2012-13.
- Sea angling supported around £2 billion of spending and 23,600 jobs in England.

Keywords: Recreational sea angling, economic impact, input-output analysis, English economy, evidence-based policy.

1. Introduction

Recreational sea angling¹ is a major pastime in many developed and lesser developed countries [3]. Recent estimates of recreational fishing in Europe have found that there are 8.7 million sea fishers, a 1.6% participation rate [4]. Related to this activity, sea anglers spend significant sums of money on their sport, impacting on local and national economies, with direct expenditure estimated to be 5.7 billion euro each year [4]. The significance of the activity should be understood not just in terms of this direct spending of recreational sea anglers but also the activities that are supported by this spending. For example, across the EU it has been estimated that there are close to three thousand companies, manufacturers and wholesalers trading in recreational angling tackle, and that these firms support an estimated 60,000 jobs [5].

In consequence changes in the level and nature of sea angling activity undertaken, perhaps leveraged by changes in the nature of stocks, catch limits, or policy could have important economic effects [6];[7]. An understanding of the economic activity supported by recreational sea angling should then be one contextual element of marine resource policy in terms of management of the stock as well as the organisation and development of the angling

¹ Recreational fishing has been defined by the ICES Working Group for Recreational Fishing Surveys as: “The capture or attempted capture of living aquatic resources mainly for leisure and / or personal consumption. This covers active fishing methods including line, spear, and hand–gathering and passive fishing methods including nets, traps, pots, and set–lines” and angling as “Fishing with hand-lines, fishing rods and/or poles using baits and/or lures” [1, section 6]. Issues relating to the definition and scope of recreational sea angling, the motivation for this activity (such as challenge, relaxation, social activity) and a contrast with commercial fishing are fully discussed in Pawson et al, [2].

sector. In this respect interventions around fisheries stock management should include not only managing the competing demands placed on different species, but also the economic and social features of fisheries (see also Hyder et al., [8]). In addition to addressing conservation goals, future co-management of European fish stocks for recreational and commercial purposes should consider how to maximize the economic and social values of the different fisheries [8]. Clearly policy needs to be developed with some understanding of the requirements of both recreational and commercial fishing, with a knowledge of the different economic effects levered by each activity (see Southwick Associates [9] for a comparison of economic impacts of recreational and commercial fishing in the United States). Understanding the economic value of sea angling is also important in developing policies to develop outdoor recreation-based tourism policies to enhance the economic value of it in what are often economically disadvantaged, small or remote rural communities [10].

While economic data and analysis on the contribution of sea angling for coastal, regional and national economies is an important input to evidence-based fisheries management policy, this paper suggests that the collection of such information is complicated by a series of factors. Establishing the population of sea anglers is difficult, as in many countries, no license or permit is required to participate in sea angling [2]. It is also difficult to separate sea angling from freshwater angling, and with significant cross overs between them where anglers may participate in a number of different types of angling at different times [11]. Sea angling also entails a very wide spectrum of different activities in terms of location, method and target species [12]; [1].

Notwithstanding these difficulties, information on the economic activity supported by sea angling, particularly when combined with data on behaviours and motivations of anglers, can 'lead to a deeper understanding of how alternative management actions can affect the fish

stock, anglers, and coastal communities' [13, p. 6]. For example, a UK context for this paper are the current limits on bass catches for both recreational and commercial anglers [14]. Whilst several measures have been implemented across Europe to reduce bass mortality, stocks have continued to decline with a zero take fishery proposed in the latest advice [15]. A further context is the ongoing international issues relating to the relative balance of effects of controlling fish stocks through commercial quotas and/or through recreational catch limits, and the introduction or expansions of 'no-take' zones and the promotion of recreational fisheries (e.g. USA saltwater recreational fisheries policy, [16]). In each of these cases, an appreciation of the value of the marine resource to recreational anglers and the wider local and national economies is relevant. Moreover, where catch limits lead to changes in the pattern of sea angling spending, and changes in the incidence of trips and angler effort, there are expected to be a series of indirect economic consequences [7].

Recreational fisheries have impacts on stocks with 27% of sea bass and western Baltic cod catches taken by recreational fishers [4]. However, a lack of recreational catch data has led to exclusion of recreational fisheries from stock assessment, which may affect the ability to manage fish stocks sustainably [8]. The European Commission introduced a Data Collection Framework (DCF) to support the Common Fisheries Policy (CFP) [17] that included estimation of recreational catches and releases for selected species (see for example EU [18]). In addition, the control regulations include reporting of recreational catches by vessels [19]. These all relate to catches and releases, but there is no requirement to provide economic information on recreational fisheries.

1.1 UK recreational sea angling valuation

Several UK studies examine the economic activity supported by recreational sea angling. Studies vary in coverage with some focussing on direct spending and economic activity

indirectly supported by this spending (e.g. Armstrong et al., [20]; Monkman et al., [21]) and others focussed more on value and the monetary value linked to the personal utility gained from participation in sea angling (e.g. Drew Associates, [22]). A series of representative studies are outlined here to reveal some of the estimation problems that research has faced and to review the methods used. Importantly some of the most important contextual studies in terms of the development of methodology involve freshwater fishing.

Drew Associates [22] examined the economic contribution of sea-angling in England and Wales. This study used the *Household Omnibus Survey* to estimate the total population of sea anglers, and to examine their socio-economic characteristics, and the type and frequency of angling. This information was then supplemented by surveys of sea anglers and suppliers to anglers. By comparing the spending of anglers with what they were willing to pay, the study estimated the personal consumer surplus benefits of angling, which were scaled up for the estimated total population. The study found that estimated total expenditure by (resident in England and Wales) sea-anglers was £538m per year from 12.7 million angler days of activity. This spending was estimated to support nearly 19,000 jobs directly and £71m of supplier income. In a similar vein Simpson and Mawle [23] examined participation in both fresh water and sea angling in England and Wales. In similarity to Drew Associates [22] omnibus surveys gauged participation rates in the population. For sea angling specifically this study revealed that 6% of the population of England and Wales had sea-fished in the 2 years preceding the study, which yielded an estimated sea angling participation of 2.8 million people.

A series of studies have sought to examine regional differentials in sea angling activity. For example, Nautilus [24] examined the economic contribution of sea-angling in the South West of England. This study estimated 240,900 resident sea-anglers in the target region, with

600,000 visitor anglers, converting to 750,000 angling days. Nautilus did not calculate any indirect or induced effects, but they did estimate the net economic value of angling ‘in the form of sea anglers’ surplus to be £77m per annum’.

Radford et al. [25] estimated the economic impact of sea angling in Scotland and examined the scale of direct as well as indirect and induced effects associated with direct spending. The study reported numbers of local and visiting anglers by type (shore, private and charter boats), target species and angler expenditure, and an estimate of the economic impact of sea angling to regional incomes and employment was made. Once again use was made of an omnibus survey. This study revealed that in 2009 sea angling in Scotland supported 3,148 full time job equivalent (FTEs) jobs, and £70m annually of Scottish household income. The study argued that a cessation of sea angling would lead to a net loss of at least 1,675 FTEs and annual income loss of £37m.

The review reveals few studies of the economic contribution of recreational sea angling in England and the UK following Drew Associates [22]. It is likely that there have been significant economic and demographic changes within angling since then. In addition the methods used in Drew Associates [22] focused on angling-specific supplier chains to the exclusion of angler expenditure estimates. This analysis also focused on angling club members, and more frequent anglers. The wider stakeholder and business survey elements of some studies have also been limited. For instance whilst Radford [25] included a stakeholder survey, it was far from an exhaustive appraisal. Utilising available data of all angling related businesses, as well as including angler spending data with non-angling businesses can provide more accurate estimates of economic value and employment, more localised impact estimates (especially in areas of deprivation) as well as the required inventory. More generally the review suggests a need for survey approaches to be flexible to explore the

complexity of angler types and resulting different sets of expenditure patterns. In addition, more recent and widespread use of email and internet technology now enables the use of online networks of anglers – including those supported by angling governing bodies, online press as well as independent forums - from which to draw part of the survey sample (although it is recognised that each contain bias).

Until recently few studies have focused on the social benefits of sea angling. However, some recent research has highlighted the specific benefits associated with sea angling, not least in identifying forms of angling that may involve higher rates of physical activity [26] and a range of associated social activities [27]; [28]. While this paper focuses on tangible economic outcomes and valuation, the method used enabled some analysis of the social contribution to be undertaken. Comment on this aspect is included later in this paper. In this respect understanding the social value of activities such as angling – in quantitative, monetised and qualitative ways – alongside understandings of specific impact areas (such as health and well-being) are now considered essential elements of social and economic impact studies in other sectors and in recreation [29]; [30].

2. Methods

A range of data and methods have been used to estimate the economic value of sea angling. These include expenditure surveys, willingness to pay data, consumer surplus analysis and economic modelling (see ICES, [13] and EFTEC, [31], for general reviews). The specific method used in this study, an expenditure survey (part of an economic and social survey) and an economic modelling framework, is outlined below.

2.1 Survey approach

A key issue identified in previous research relates to gaining representative samples of sea anglers, given the wide diversity of activity undertaken, but at the same time to gain reliable estimates of the population of sea anglers. A key element of the research was an opinions survey conducted by the Office for National Statistics (ONS) [32], to provide statistics on the numbers, distribution and activities of sea anglers in England. In addition, a more targeted set of surveys were used to gain insight into the spending patterns of individual anglers, the social benefits, and the businesses serving the angling community.

The surveys encompassed, an online survey of sea anglers examining economic (spending) effects, social benefit, participation and demographic profile (economic and social survey). This was supplemented by a smaller number of face-to-face surveys using an identical set of questions to the above, but conducted face-to-face with anglers at five representative sea angling locations in England (Northumberland, Deal, Lowestoft, Weymouth and Liverpool). Site based research was conducted throughout the period from March 2012 to February 2013 and allowed collection of data from some groups who were more likely to be under-represented in the self-select online survey, such as more occasional anglers, holidaymakers, and those not engaged within angling organisations. Finally there was a survey of angling-related businesses at these five case sites to help inform spending impacts in the localities.

Previous studies (see for example, Drew Associates, [22]; Stolk, [26]; Brown et al., [33]) revealed a wide variety of angler types and behaviours. It was therefore important to have a multi-level approach to capture the breadth of types of sea angler as well as to safeguard against non-response bias. In summary, the approach was multi-faceted, particularly in terms of the combination of ONS estimates of the population and characteristics of sea anglers, with more detailed surveys of spending and other activity (Figure 1). The approach included:

- Using both face-to-face/site intercept and online survey data collection.

- Ensuring as wide a response as possible to the online survey through extensive publicity in angling and non-angling networks.
- Conducting face-to-face interviews at five regional sites representing a variety of sea angling locations and at different stages in the year to address seasonal bias.
- Addressing bias in the sample using information supplied by the ONS opinions survey, on demographics and angler activity, notably by re-weighting the sample obtained during the economic survey using ONS data on age profile and frequency of angling.
- Through collection of demographic and location (postcode) data the profile of respondents could be assessed and compared to other national surveys of this type as well as against other surveys in *Sea Angling 2012*. This included comparison of age, gender, income and disability.

The overall sea angler sample size generated (after cleaning and removal of those living outside England) was 2,842 usable responses. This was made up of 2,502 online and 340 face-to-face respondents (at the five separate coastal locations).

[Figure 1 about here]

2.2 Estimating direct economic effects

The economic and social survey tools asked anglers to detail how much they spent on various items, and this spending was subsequently grossed-up using the ONS survey data to represent the total population of sea anglers, and to provide an estimate of total (gross) expenditure by sea anglers. A disaggregated grossing-up process was designed to overcome the expected issues of avidity bias in the survey data. This process involved splitting the survey data by

two key angler characteristics, frequency of angling and age, to allow comparison to ONS data and re-weighting. Three frequency of angling categories were used. These were occasional (up to 12 days of fishing per year), regular (13 – 35 days) and frequent (more than 36 days per year). These were combined with five different age categories (16 - 24, 25 - 44, 45 - 54, 55 - 64, 65+). This meant that the survey results were split into 15 different groups. Average profiles were derived for each group, and these were then grossed up to the total population of each group as estimated by the ONS survey. The grossed-up total was therefore weighted to the ONS estimated population of sea anglers in England (see Figure 1).

The economic and social survey requested information on the last (for online surveys) and current (for face-to-face surveys) trip spending (on items such as bait, transport, harbour fees and food and drink), the duration of the trip, and the number of trips per year. This was the information upon which estimates of annual fishing effort were made. This approach therefore assumes that on average, over the full sample, the last trip was representative of all trips during the year.

Spending on major items included the purchase of boats ('that are used mostly for sea angling'), rods, reels and specialist clothing ('bought specifically for sea angling'). Expenditure on these items will vary significantly from year to year. Here estimates were derived from the online and site surveys of angler's expenditure during the last year. Whilst there is expected to be significant recall bias for periods of one year, angler recall is likely to be more accurate over the last year than for longer periods. Some anglers will have bought major items during that year, but will use them over several years. Conversely some anglers may not have purchased any major items during the last year. Over the sample of more than 2,800 respondents, these impacts are assumed to balance out, to provide an average profile of spending on major items during the year.

Once a grossed-up total expenditure figure was derived for English recreational sea anglers, the total needed to be adjusted for expenditure leakages outside of the English economy (Figure 1). For example, whilst fishing rods may be bought via retailers in England, this item is likely to have been imported to England from overseas. Thus, it was necessary to make assumptions about the English import propensities on goods and services used by sea anglers. These assumptions were informed by consultations with industry representatives, and by reference to import information on selected goods and services from the ONS. For example, information on import penetration by different types of products is available within UK Supply and Use Tables, see ONS [34].

Other adjustments to spending were made to account for VAT and other taxes which are included within the spending made by sea-anglers. For example, purchases of fishing equipment will include an element relating to VAT, whilst spending on fuel also includes excise duties. Information for these tax adjustments is available from UK Government [35] and from the UK Supply and Use Tables, see ONS [34]. The estimated taxes and imports were then deducted from the spending on various items in order to identify spend which is relevant for each item i.e. spend which will subsequently generate economic impacts within particular parts of the economy (see below). This relevant spend was then disaggregated and appropriately allocated to sectors of the economy in order to estimate the economic significance of that spending. The result of this process was an estimate of the direct net spending of sea anglers which is retained within the English economy, this then became the main input into the economic model.

2.3 Estimation of Indirect and Induced-Income Effects

It was necessary to adopt an approach that allowed an estimation of the indirect and induced effects resulting from sea-angler direct spending on England-produced goods and services.

Input-output methods enable such estimates to be made, by tracing the expenditure flows through the economy. These methods have a long and well-regarded history of use in studies of economic significance and economic impacts, ranging from sector studies to events and general economy changes. The ‘base’ tables used for the analysis were the 2004 UK industry-by-industry analytical Input-Output tables [36]. However modifications to these tables were required. The tables were adjusted to firstly reflect price changes since 2004 and secondly to represent the economy of England, rather than the UK. This adjustment was made largely using a simple location quotient approach. Whilst there are a number of well-known problems in using such mechanical adjustments, these are likely to be limited in this case, as England is the largest component area of the UK economy. Input-Output methods do however rely on the use of assumptions which may limit their application. A general review of the constraints of using Input-Output frameworks for modelling purposes can be found in Miller and Blair [37] and Allan et al, [38], while Surís-Regueiro et al, [39] provides a discussion of the use of the Input-Output methodology in the context of estimating the socio-economic impacts of the fishing sector in Spain.

The direct expenditure was incorporated as a positive consumption shock within the estimated national Input-Output framework (for England). Through the use of Input-Output coefficients, and hence multipliers (derived from industry production functions), the effect of sea-angler spending can be traced through the economy’s supply chains, ultimately estimating indirect and induced-income effects. These indirect and induced-income effects, when added to the direct effects, provide an estimate of the total effects of sea angler expenditure.

As well as expenditure or output effects, estimates were made of the impacts on gross value-added (GVA) and employment. GVA comprises of items such as wages and salaries,

and company profits and surpluses, and is often considered as a more appropriate measure of impact. The output effects were translated into GVA impacts using information from within the derived Input-Output tables on the ratio of GVA to a single unit of output for each industry, whilst industry employment/output ratios (estimated using employment information from NOMIS [40] combined with industry output data from the Input-Output tables) were used to estimate employment impacts in terms of full-time equivalent (FTE) jobs.

3. Results

The total annual spend of recreational sea anglers in England was estimated for each spending category, and with the total broken down by trip related spending, and major item spending (Table 1). The information in this table represents a grossed-up number based on the sample of 2,852 online and site survey returns, Total trip spending in 2012-13 was an estimated £673m excluding purchases which would be categorised as major spend but which were bought during angling trips (Table 1).

[Table 1 about here]

Spending on major items totalled an estimated £560m. Adding together trip and major spend items gives an all-England total of £1.23bn of total sea angler spending. Annual trip spend per sea angler was estimated at £761 and annual spend on major items was £633 per sea angler, giving an overall total of £1,394 per sea angler, equivalent to around £27 per week of spending in 2012-13 (Table 1). The main items of spend included boats (£177.7m and around 14% of the total); bait (£141m and around 11% of the total); and food and drink (£135.1m, 11% of the total).

To enable the re-weighting of the results, the survey data was split into different age and frequency categories (Section 2.2). Unsurprisingly, average annual spend per angler was higher for frequent and regular anglers (£3,161 and £2,454 respectively), compared with occasional anglers (£708) who were the largest category in terms of the number of resident anglers. There was also variation in average angler spend in the different age categories. However the most significant variation was for the 55-64 age group, where spending was more than 50% above the average annual spend per angler.

For the purposes of later economic analysis the more detailed distribution of angling spend is important. For example, the three spending items of accommodation, food and drink and bait (Table 1) largely encompass goods and services produced in England. However, in the case of items such as rods and reels a large proportion of the spending is on goods imported into the UK.

In analysing the economic effects of sea angling it is important to understand how spending on some items leaks out of the English economy by defined industry group. The spending by category/item (Table 1) was allocated to industry groups in England, or to imports or tax (Table 2). By examining the detailed breakdown of trip and major item spending it is possible to see the industries which were supported by recreational sea angling activity. The annual spending figure of £1.23bn fell to £831m once account was taken of imports and taxes, the latter largely relating to VAT (Table 2). For every £1 spent on recreational sea angling, an estimated one third relates to spend on imports and taxes. Of the £831m net of import and taxes, around £200m of sea angling spending accrues to the wholesale and retail sector; £180m to machinery, electronics and transport equipment; and £154m to hotels and restaurants (Table 2).

In excess of £200m of tax payments were included within the £1.23bn of sea angler gross spending (Table 2). This was estimated by analysis of purchases made but can only be indicative of the direct tax-take relating to such spending. For example, taxes will accrue to the government and will subsequently be spent, hence supporting economic activity, and the extent of these impacts will depend on how such taxes are spent.

[Table 2 about here]

By combining the information on spend (Table 2) with employment and GVA ratios for the defined industries, the £831m of sea angler spend on domestically produced goods and services (Table 2) was estimated to directly support some 10,400 FTE jobs and almost £360 million of GVA in England (Table 3). In summary then it can be estimated that every 100 recreational sea anglers support 1.2 jobs in the English economy through their (direct) spending on goods and services. Moreover, every £1m overall gross sea angling spending supported 8.5 jobs in England and £0.29 million of GVA.

It was important to estimate the additional, knock-on benefits associated with the direct expenditure, in order to provide a more comprehensive assessment of the economic impacts of this spending. The direct expenditures by industry (shown in the top section of Table 2, which sum to £831.4m) were used as the inputs into the economic model. Specifically this became the direct expenditure vector, which, when incorporated within the Input-Output modelling framework, and through the use of multipliers, enabled estimation of the consequent indirect and induced effects (Table 3).

The £831m of direct sea angler spending supported an estimated total of £2.1 billion of total spending once indirect and induced effects are accounted; a total of over 23,600 jobs and almost £980 million of GVA (Table 3). Note here that total effects included direct, indirect

and induced effects. Each £1m of net sea angler spending in England supported another £1.5m of spending in the English economy, and each £1m of gross sea angler spend in total supported 19.2 jobs and £0.79 million of GVA (Table 3). Moreover, every 100 recreational sea anglers supported around 2.7 jobs in the English economy through their spending on goods and services and associated indirect and induced effects.

[Table 3 about here]

4. Discussion

The figures derived from the approach do not imply that a reduction in the recreational sea angling activity would result in a loss to the economy of the magnitudes reported (Table 3). For example, were all angling options to be closed, some would substitute spending to other pastimes [25].

The context for the study was the need for better estimates on the economic activity supported by sea angling expenditure for use as an input into evidence-based marine policy making, and the problems of establishing estimates of the population of sea anglers. This will be a challenge for future research where specific pastime and spend questions need to be included in UK-wide omnibus surveys, and difficulties accessing a representative sample of anglers. However, this study developed a rich source of individual angler spending and demographic information such that the key challenges for estimation purposes were in terms of grossing up these micro-estimates.

It is perhaps a simplistic point to say that increasing the numbers of people who go sea angling will increase the economic and social benefits it can deliver. However, an increasing participation cannot be assumed. The online survey element of this study contained a number of open ended questions and these revealed concerns of sea anglers in terms of the impacts of a decline of inshore fish stocks as a barrier to greater participation (and therefore arguably increased social and economic benefits).

While the focus of the research has been on economic benefits there are aspects of recreational sea angling that are more difficult to value. For example, a series of questions in the survey revealed the importance of sea angling in terms of a means to ‘relax and get away from things’ and as a route for people to socialise (see also Parkkila et al., [41]; MacManus

[42]; Monkman et al., [21] on the social value of angling). For example, around 38% of the survey respondents said that they had made friends through sea angling and 30% said that it had meant they mixed with people from different backgrounds. Sea angling can also be connected to health benefits. For 41% of the respondents, sea angling was a way to get active, with 24% rating their sea angling as a high intensity activity (something particularly relevant to sports policy concerns). The average duration of sea angling sessions at between 5 and 7 hours means that the energy consumption is significant.

A better understanding the range of social, economic and environmental benefits levered by sea angling will become more important as decisions on marine management are taken within an ecosystem services framework. Europe is currently lacking a management framework that attempts to balance these benefits in relation to sea angling and commercial fishing [8]. This research has made some contribution to the evidence base on which such management policy can be formulated. Whilst the significant economic value of sea angling has been recognised at a European level, this study confirms the importance of sea angling to the English economy generally, and to some coastal communities. There is the need for a multidisciplinary approach, incorporating stakeholder groups to develop appropriate management frameworks [8]. In addition, survey data, such as that generated through this research, can be used further understand the links between angling participation and expenditures, and the potential effects of changes in catch rates etc. [43]; [44]; [45]. Alternative methods for estimating the economic effects of sea angling, such as willingness to pay, or willingness to accept, could be further explored to compare, verify and update the estimates contained within this paper over time.

Acknowledgement

This research was part of a wider *Sea Angling 2012* project funded by the Department for Environment, Food and Rural Affairs (Defra) contract MF1221 and the Marine Management Organisation. The project involved collaboration between the Marine Management Organisation (MMO), the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), research company Substance, Cardiff University, and the Inshore Fisheries and Conservation Authorities (IFCAs).

References

- [1] International Council for the Exploration of the Sea (ICES) (2013). *Report of the ICES Working Group on Recreational Fisheries Surveys (WGRFS)*, 22-26 April, Esporles, Spain. ICES CM 2013/ACOM:23. 49 pp. Available from: <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2013/WGRFS%202013/WGRFS%20Report%202013.pdf> (Accessed 15.5.17)
- [2] Pawson, M., Glenn, H. and Padda, G. (2008). The definition of marine recreational fishing in Europe. *Marine Policy*, 32, 339–350. doi:10.1016/j.marpol.2007.07.001
- [3] Cisneros-Montemayor, A.M. and Sumaila, U.R. (2010). A global estimate of benefits from ecosystem-based marine recreation: potential impacts and implications for management. *Journal of Bioeconomics*, 12, 245–268. doi: 10.1007/s10818-010-9092-7
- [4] Hyder, K. and Strehlow, H.V. (2017). *Recreational sea fishing in Europe – participation rates, fishing effort and expenditure in a global context*. Paper presented at the UK sustainable fisheries management & recreational sea fisheries event, Brussels, 8 March. Available from: www.eaa-europe.org/files/rec-sea-fish-europe-kieran-hyder-v04_8377.pdf (Accessed 15.5.17)
- [5] Dillon, B. (2004). *A bio economic review of recreational angling for bass*. Report for East Riding of Yorkshire Council Integrated Coastal Zone Management Group. Available from: <http://www.hull.ac.uk/coastalobs/media/pdf/bass.pdf> (Accessed 15.5.17)
- [6] Steinback, S.R. (1999). Regional economic impact assessments of recreational fisheries: An application of the IMPLAN modeling system to marine party and charter boat

fishing in Maine. *North American Journal of Fisheries Management*, 19, 724–736.

doi: [10.1577/1548-8675\(1999\)019<0724:REIAOR>2.0.CO;2](https://doi.org/10.1577/1548-8675(1999)019<0724:REIAOR>2.0.CO;2)

[7] Lee, M.-Y., Steinback, S. and Wallmo, K. (2017) Applying a Bioeconomic Model to Recreational Fisheries Management: Groundfish in the Northeast United States. *Marine Resource Economics*, 32, 191-216. doi: 10.1086/690676

[8] Hyder, K., Armstrong, M., Ferter, K. and Strehlow H. (2014). Recreational sea angling – the high value forgotten catch. *ICES INSIGHT* 51: 8-15. Available from: <http://ices.dk/sites/pub/Publication%20Reports/ICES%20Insight/ICES%20Insight%202014.pdf> (Accessed 15.5.17)

[9] Southwick Associates (2013). *Comparing NOAA's recreational and commercial fishing economic data*. Report produced for the American Sportfishing Association.

Available from:

http://asafishing.org/uploads/Comparing_Recreational_and_Commercial_Marine_Fishing_Data_Report_May_2013.pdf (Accessed 15.5.17)

[10] Brown, A. (2012a). *Assynt angling research: Final report*. Manchester, Substance.

Available from:

<http://www.assyantanglinginfo.org.uk/sites/resources.anglingresearch.org.uk/files/Assynt%20Angling%20Final%20Report%20Feb2012.pdf> (Accessed 15.5.17)

[11] Brown, A. (2012b). *National Angling Survey*. Manchester, Substance. Available from:

http://www.resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/National_Angling_Survey_Report_2012.pdf (Accessed 15.5.17)

[12] Food and Agriculture Organization of the United Nations (FAO) (2012) Recreational fisheries. FAO Technical Guidelines for Responsible Fisheries. No. 13. Rome.

Available from: <http://www.fao.org/docrep/016/i2708e/i2708e00.htm> (Accessed 15.5.17)

- [13] International Council for the Exploration of the Sea (ICES). (2014). *Report of the Working Group on Recreational Fisheries Surveys (WGRFS)*, 2-6 June, Sukarrieta, Spain. ICES CM 2014\ACOM:37. 662 pp. Available from: <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2014/WGRFS/WGRFS%20Final%20Report%202014.pdf> (Accessed 15.5.17)
- [14] European Union (EU) (2017). Council Regulation (EU) 2017/127 of 20 January 2017 fixing for 2017 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union waters. *Official Journal of the European Union*, L24/1. Available from: <http://data.europa.eu/eli/reg/2017/127/oj> (Accessed 15.5.17)
- [15] International Council for the Exploration of the Sea ICES (2016). *Sea bass (Dicentrarchus labrax) in divisions 4.b–c, 7.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea)*. Available from: <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/bss-47.pdf> (Accessed 15.5.17)
- [16] National Oceanic and Atmospheric Administration (NOAA) (2015) *National Saltwater Recreational Fisheries Policy*. Silver Spring, Maryland, USA. Available from: http://www.nmfs.noaa.gov/sfa/management/recreational/documents/noaa_recfish_policy.pdf (Accessed 15.5.17)
- [17] European Union (EU) (2013) Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy.

Official Journal of the European Union, 354, 22–61. Available from:

<http://data.europa.eu/eli/reg/2013/1380/oj> (Accessed 15.5.17)

[18] European Union (EU) (2016) Commission implementing decision (EU) 2016/1251 of 12. July 2016 *adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017-2019*. 2016/4329. Available from:

http://data.europa.eu/eli/dec_impl/2016/1251/oj (Accessed 15.5.17)

[19] European Union (EU) (2009) Council Regulation (EC) No. 1224/ 2009 of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy. *Official Journal of the European Union*, L343, 1–50. Available from: <http://data.europa.eu/eli/reg/2009/1224/oj> (Accessed 15.5.17)

[20] Armstrong, M., Brown, A., Hargreaves, J., Hyder, K., Pilgrim-Morrison, S., Munday, M., Proctor, S., Roberts, A. and Williamson, K. (2013). *Sea Angling 2012 – a survey of recreational sea angling activity and economic value in England*. London, DEFRA. Available from:

http://randd.defra.gov.uk/Document.aspx?Document=12025_SeaAngling2012synthesisisreportFINAL.pdf (Accessed 15.5.17)

[21] Monkman, G., Cambie, G., Hyder, K., Armstrong, M., Roberts, A. and Kaiser, M.J. (2015). *Socioeconomic and Spatial Review of Recreational Sea Angling in Wales*. Fisheries and Conservation Report No. 52, Bangor University. Available from:

<http://fisheries-conservation.bangor.ac.uk/documents/52.pdf> Accessed (15.5.17)

[22] Drew Associates (2004). *Research into the economic contribution of sea angling*. Drew Associates. Available from:

http://resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/Economic_Impact_Sea_Angling_England_Drew_Report_2004.pdf (Accessed 15.5.17)

[23] Simpson, D. and Mawle, G.S. (2010). *Public attitudes to angling 2010*. Environment Agency Report. Available from:

http://resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/E_A_Public_Attitudes_to_Angling_2010.pdf (Accessed 15.5.17)

[24] Nautilus (2006). *The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region*, Report for Invest in Fish South West. Available from:

http://resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/The_Motivation,_Demographics_&_Views_of_SW_Recreational_Sea_Anglers.pdf

(Accessed 15.5.17).

[25] Radford, A., Riddington, G. and Gibson, H. (2009). *Economic impact of recreational sea angling in Scotland (Technical Report)*. Edinburgh: Scottish Government.

Available from: <http://www.gov.scot/resource/doc/280648/0084568.pdf> (Accessed 15.5.17)

[26] Stolk, P. (2010). *Angling and physical activity: Theme paper 3*, Manchester: Substance.

Available from:

<http://resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/Theme%20Paper%203%20Angling%20and%20Physical%20Activity.pdf> (Accessed

15.5.17)

[27] Brown, A., Djohari, N. and Stolk, P (2012). *Fishing for answers: The final report of the social and community benefits of angling research*. Manchester, Substance. Summary

available from:

http://www.resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/Substance_AnglingReport_IntroExecSum.pdf (Accessed 15.5.17)

[28] Brown, A. (2016) Angling Trust Insight Research, Manchester: Substance. Available from: <http://www.substance.net/wp-content/uploads/Angling-Trust-Participation-Insight-Report-copy.pdf> (Accessed 15.5.17)

[29] Department for Culture, Media and Sport (DCMS) (2015) *Sporting Future - A New Strategy for an Active Nation*. Available from: <https://www.gov.uk/government/publications/sporting-future-a-new-strategy-for-an-active-nation> (Accessed 15.5.17)

[30] Sport England (2016) *Towards an Active Nation: Strategy 2016-2019*. Available from: <https://www.sportengland.org/media/10629/sport-england-towards-an-active-nation.pdf> (Accessed 15.5.17)

[31] EFTEC (2015). *Comparing industry sector values, with a case study of commercial fishing and recreational sea angling*. Report for the UK Fisheries Economics Network. Available from: http://www.seafish.org/media/publications/eftec_comparing_industry_sector_values_FINAL_Aug_2015.pdf. (Accessed 15.5.17)

[32] Hargreaves, J., Pilgrim-Morrison, S., Williamson, K., Brown, A., Armstrong, M. and Hyder, K. (2013). *Sea Angling 2012 – a survey of recreational sea angling activity and economic value in England. Annex 1: A household survey of recreational sea angling*. Available from:

<http://webarchive.nationalarchives.gov.uk/20140108121958/http://www.marinemanagement.org.uk/seaangling/documents/finalreport.pdf> (Accessed 15.5.17)

[33] Brown, A., Edgar, K., Mellor, G. and Bain P. (2013). *RNLI audience profiling research: Coastal anglers final report*. Unpublished: RNLI. Summary available from: <http://rnli.org/aboutus/aboutthernli/Documents/angling-research-report.pdf> (Accessed 15.5.17)

[34] Office for National Statistics (ONS) (online). *Input-output supply and use tables*. Available from: <http://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables> (Accessed 15.5.17)

[35] UK Government (Online). *VAT Rates*. Available from: <https://www.gov.uk/vat-rates> (Accessed 15.5.17)

[36] Turner, K. (2009). 2004 UK industry-by-industry analytical Input-Output tables. Available from: <https://www.strath.ac.uk/business/economics/fraserofallanderinstitute/research/economicmodelling/> Accessed (15.5.17)

[37] Miller, R. and Blair, P. (2009). *Input-output analysis: Foundations and extensions*, Cambridge, Cambridge University Press.

[38] Allan, G., Lecca, P., McGregor, P. and Swales, J.K. (2014). The economic impacts of marine energy developments: A case study from Scotland. *Marine Policy* 43, 122-131. Doi: 10.1016/j.marpol.2013.05.003

- [39] Surís-Regueiro, J., Garza-Gil, M., Varela-Lafuente, M. (2014). Socio-economic quantification of fishing in a European urban area: The case of Vigo. *Marine Policy*, 43, 347-358. Doi: 10.1016/j.marpol.2013.07.005.
- [40] NOMIS (Online). Official labour market statistics. Available from: <https://www.nomisweb.co.uk/> (Accessed 15.5.17)
- [41] Parkkila, K., Arlinghaus, R., Artell, J., et al. (2010) European Inland Fisheries Advisory Commission. Methodologies for Assessing Socio-Economic Benefits of European Inland Recreational Fisheries. EIFAC Occasional Paper 46, 112pp. Available from: <http://www.fao.org/docrep/013/i1723e/i1723e00.htm> (Accessed 15.5.17)
- [42] McManus, A., Storey, J. and White, J. (2011). *Identifying the health and well-being benefits of recreational fishing*. FRDC Project Number: 2011/217. Available from: <http://cessh.curtin.edu.au/local/docs/RecFishinglr.pdf> (Accessed 15.5.17)
- [43] Arlinghaus, R., Tillner, R. and Bork, M. (2015). Explaining participation rates in recreational fishing across industrialised countries. *Fisheries Management and Ecology* 22, 45–55. doi: 10.1111/fme.12075
- [44] Johnston, F.D., Beardmore, B., Arlinghaus, R. and Trenkel, V. (2015) Optimal management of recreational fisheries in the presence of hooking mortality and noncompliance — predictions from a bioeconomic model incorporating a mechanistic model of angler behavior. *Canadian Journal of Fisheries and Aquatic Sciences*, 72, 37–53. doi: 10.1139/cjfas-2013-0650
- [45] Prayaga, P., Rolfe, J. and Stoeckl, N (2010). The value of recreational fishing in the Great Barrier Reef, Australia: A pooled revealed preference and contingent behaviour model. *Marine Policy*, 34, 244-251. Doi: 10.1016/j.marpol.2009.07.002

Figure 1: Outline of main sources and methods

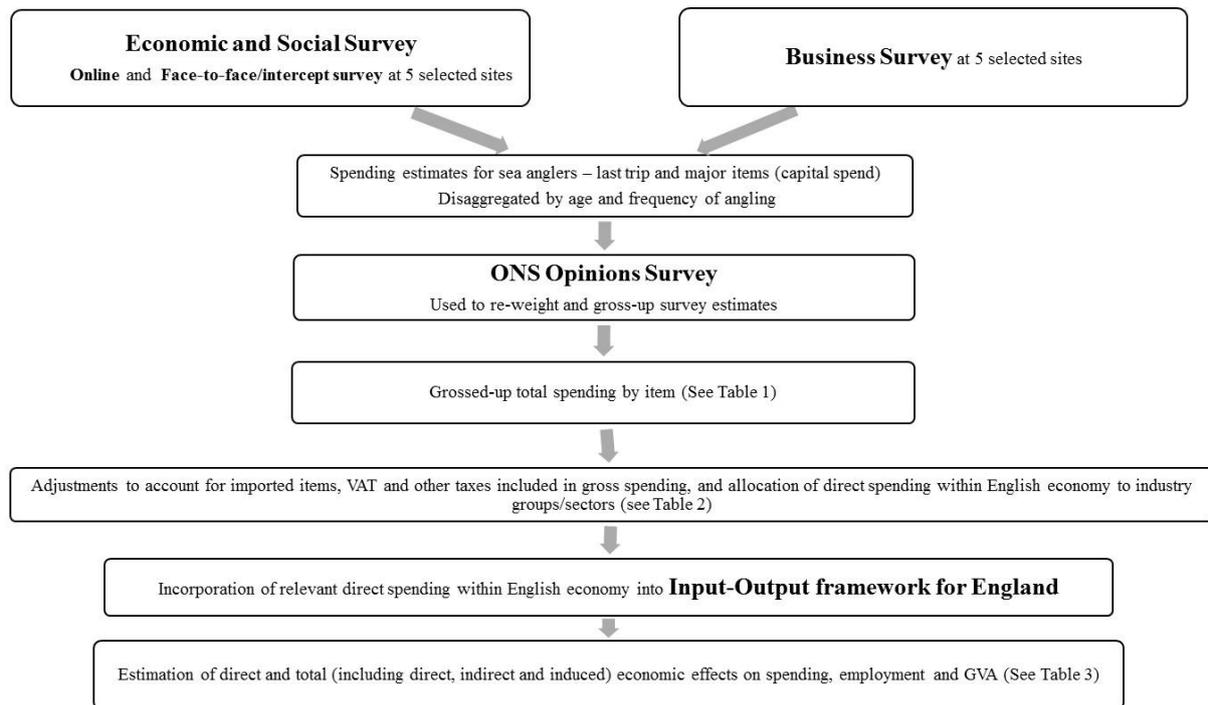


Table 1. Items of trip and major spend by recreational sea anglers, 2012-13.

Category	Percentage of total annual spend
Trip spend	
Accommodation	8.7
Food and drink	11.0
Bait	11.4
Other fishing equipment	3.6
Car parking	1.5
Pier/harbour/launch fees	1.4
Charter boat/ boat hire	9.3
Boat fuel	2.8
Public transport	0.5
Other spending (incl. car fuel etc.)	4.4
Trip spending items	54.6
	£672.6m (£761 per angler)
Major spend items	
Rods and reels	10.7
Fishing clothing	3.3
Other equipment	2.6
Terminal tackle	4.0
Boats / kayaks	14.4
Boat engines /equipment	7.7
Other major spending	2.8
Major spend total	45.5
	£559.9m (£633 per angler)
Overall Total	100.0
	£1,232.6m (£1,394 per angler)

Note: Totals may not sum due to rounding. The 95% confidence interval for the total annual spend of £1,232.6m is estimated at +/- £357.6m. This estimate is indicative of the potential variation in total spending.

Source: Survey

Table 2. Distribution of recreational sea angler spend by industry in England, 2012-13.

Industry group	Selected Items	Spend £m
Agriculture, fishing, food and clothing	Bait, selected food and drink, clothing	127.6
Machinery, electronics and transport equipment	Boats, engines, other major items	179.6
Other manufacturing	Fishing equipment, rod and reels, terminal tackle	24.9
Wholesale and retail	Retails margin on a range of purchases listed in Table 1, including rods and reels, boats, engines, clothing	199.1
Hotels and restaurants	Accommodation, selected food and drink	153.7
Transport and transport services	Car parking, pier fees, public transport, selected charter fees.	94.1
Other services	Selected charter fees	52.4
Total		831.4
Imports	Imports of a range of items bought via retailers, such as rod, reels, food and drink, clothing.	199.2
Tax	VAT on a relevant purchases listed in Table 1 (for example, on accommodation and equipment purchases) plus tax on fuel.	202.1
Total overall spend		1,232.6

Source: Survey and Authors' estimates

Table 3. The contribution of recreational sea angling to the English economy, 2012-13.

	Spending / output £m		Employment FTE		GVA £m	
	Direct	Total	Direct	Total	Direct	Total
Agriculture, fishing, food and clothing	127.6	235.6	1,698	2,635	54.6	91.4
Machinery, electronics, transport equipment	179.6	227.7	1,187	1,505	53.9	68.6
Other manufacturing, energy, construction	24.9	233.9	184	1,462	12.5	84.6
Wholesale and retail	199.1	379.8	2,723	5,194	100.1	197.3
Hotels and restaurants	153.7	197.2	2,800	3,591	67.7	89.2
Transport and transport services	94.1	223.4	1,161	2,758	38.8	92.3
Finance, business, public and other services	52.4	599.7	639	6,474	29.9	354.9
Total	831.4	2,097.3	10,392	23,619	357.5	978.4

Note: Totals may not sum due to rounding.

Source: Survey and Authors' estimates